

Hyperspectral Remote Sensing of the Coastal Ocean: Adaptive Sampling Forecasting of Nearshore In Situ Optical Properties

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LONG-TERM GOALS

A primary goal of the Oceanographic Systems Laboratory is the development and advancement of autonomous underwater vehicles. Efforts in this area include both vehicle engineering and operations to collect oceanographic data in support of science programs.

OBJECTIVES

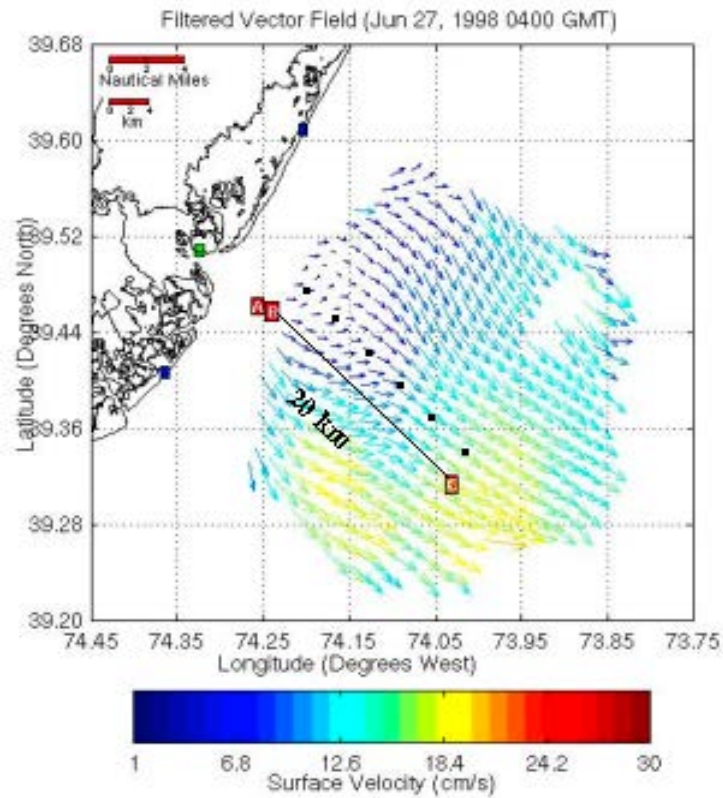
Our program objectives are to 1) design and fabricate an optical sensor package and integrate it into a REMUS vehicle fitted with an up-and-down looking ADCP and CTD; 2) operate this REMUS AUV at the LEO-15 site in support of the HyCODE experiment; and 3) generate data sets that support physical/optical/biological modeling studies.

APPROACH

The need for optical and biological data to support new studies resulted in the integration of new sensors into the REMUS vehicle. These sensors, a fluorometer (WetStar from WetLABS) and seven-channel up and down looking radiometers (OCR-507 model from Satlantic), were integrated in a new sensor module mounted between the vehicle nose and housing end cap. The radiometer channels were at 412, 443, 490, 510, 555, 670 and 683 nanometers. The new sensors also resulted in a change in operations. Since it was important to collect data above and below the thermocline, the REMUS vehicle was programmed to profile between pre-determined depths or an upper depth limit and an altitude above the bottom.

The REMUS data has primarily been used by our collaborators at the LEO-15 site. After each mission, the data is downloaded and transferred to computers at the site. Some of the data is used immediately to support model forecasts. Other data is analyzed at a later time.

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REMUS trackline location in CODAR current field at the LEO-15 site

WORK COMPLETED

The optical sensor package was designed, fabricated, and integrated into a REMUS vehicle. Software was added to log data from the new sensors and initiate data analysis after completion of each mission.

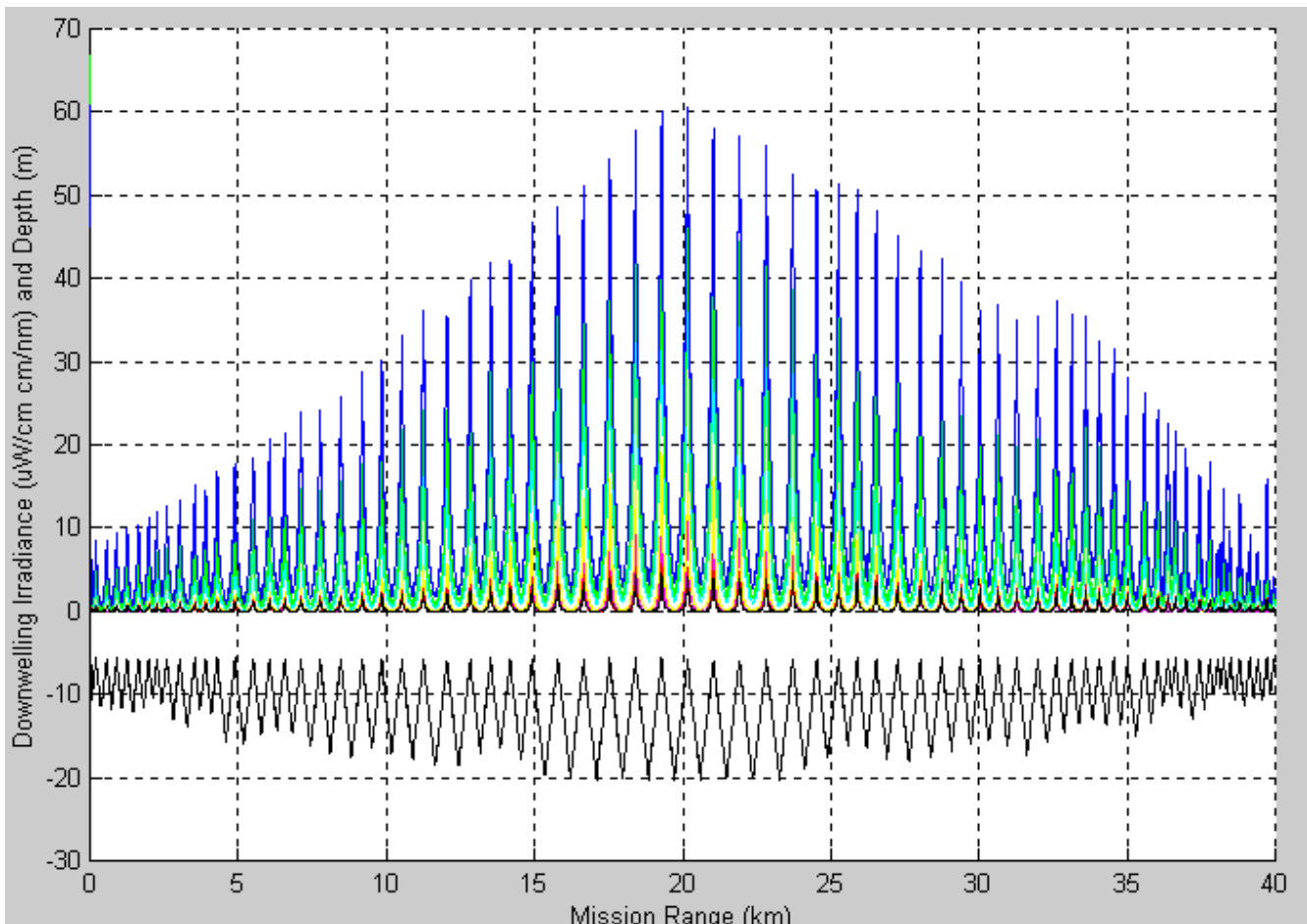


REMUS AUV with Optical Sensor Package

Survey work with a variety of REMUS vehicles is now being performed at the LEO-15 site independently by researchers from Naval Underwater Warfare Center and California Polytechnical Institute.

RESULTS

REMUS data was used in model forecasts during the HyCODE experiment. A plot of the downwelling radiometer data is shown in the following figure. This data is from a 40 kilometer mission, 20 km on the offshore leg and 20 km on the onshore leg. Symmetry in the depth data is evident. Variations in irradiance are primarily due to time of day. The REMUS vehicle reached the turn around point near midday, resulting in a roughly symmetric irradiance plot.



Irradiance and Depth Data from a 40 km REMUS Mission

Other results included temperature, salinity, pressure, uplooking radiance, fluorometry, and currents in three axes throughout the water column. This data will be used to support physics, chemistry, and biology studies and modelling efforts. The data will eventually be available through the Rutgers Oceanographic Data Access Network.

IMPACT/APPLICATION

The performance of the REMUS vehicle demonstrates the powerful capability of an autonomous vehicle as a data collection platform. Advantages of the REMUS AUV include significant reductions in shadowing, increased spatial coverage, and simultaneous measurement of physical properties. Continued use of AUV's for optical studies offers a new technique for significantly increasing data collection.

TRANSITIONS

Dr. Mark Moline has purchased and is now using a REMUS vehicle for bioluminescence studies.

RELATED PROJECTS

There are several other HyCODE projects simultaneously ongoing at the LEO-15 site. These include the efforts of Dr. Schofield, Dr. Mark Moline, Dr. Yogi Agrawa, and Dr. Scott Pegau. In addition, REMUS data is used by Dr. Scott Glenn for coastal modeling and forecasting studies. OSL also developed and continues to support the optical instrument profiling system which is deployed at one of the LEO-15 nodes.

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